

# Core app quality<sup>1</sup>

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A useful way to evaluate [app excellence](#) is to walk through the workflows in your app and evaluate the smoothness and safety of the app experience.

This checklist defines a set of core quality criteria and associated tests to help you assess the quality of your app. Some of these criteria might be easy to miss, and the tests help you remember to include them in your test plans.

The checklist highlights the minimum quality that all apps should meet. Your testing will likely go well beyond what's described here.

Each item in the quality checklist has a unique ID which you might find helpful to use when you communicate with your team. You can also [view the previous version of these guidelines](#).

## Visual experience

Your app should provide standard Android visual design and interaction patterns where appropriate, for a consistent and intuitive user experience.

We recommend using [Material Design Components](#) for creating a user interface in place of Android platform components where possible. This enables the modern Android look and feel, and it helps provide UI consistency across Android versions.

Area	ID	Tests	Description
Navigation	VX-N1	<a href="#">CR-3</a>	The app supports standard <a href="#">Back button navigation</a> and does not make use of any custom, on-screen "Back button" prompts.
	VX-N2	<a href="#">CR-3</a>	The app supports <a href="#">gesture navigation</a> for going back / going to the home screen.
	VX-N3	<a href="#">CR-1</a>	The app correctly preserves and restores user or app state.
		<a href="#">CR-3</a> <a href="#">CR-5</a>	The app preserves user or app state when leaving the foreground and prevents accidental data loss due to back-navigation and other state changes.  When returning to the foreground, the app should restore the preserved state and any significant stateful transaction that was pending. Examples include: changes to editable fields, game progress, menus, videos, and other sections of the app or game.  <ol style="list-style-type: none"><li>1. When the app is resumed from the Recents app switcher, the app returns the user to the exact state in which it was last used.</li><li>2. When the app is resumed after the device wakes from the sleep (locked) state, the app returns the user to the exact state in which it was last used.</li><li>3. When the app is relaunched from Home or All Apps, it should do one of the following, depending on how much time has passed since it was last used:</li></ol>

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<sup>1</sup> <https://developer.android.com/docs/quality-guidelines/core-app-quality>

- If the app was last used a short time ago (minutes), restore the app state as close as possible to its previous state.
- If more time has passed since the app was last used, try to restore the app as close as possible to its previous state; or start it from its home screen or some other default state.

Notifications	VX-S1 <a href="#">CR-9</a>	<p>Notifications follow design <a href="#">guidelines</a>. In particular:</p> <ol style="list-style-type: none"> <li>1. Notifications are not used for cross-promotion or advertising another product, as this is strictly prohibited by the Play Store.</li> <li>2. <a href="#">Notification channels</a> are defined according to best practices, rather than serving all notifications from one channel.</li> <li>3. Selecting <a href="#">the correct notification priority</a>.</li> <li>4. Multiple notifications are stacked into <a href="#">a single notification group</a>, where possible.</li> <li>5. Set <a href="#">timeouts</a> for notifications where appropriate.</li> <li>6. Notifications are persistent only if related to ongoing events, such as music playback or a phone call. For more information, see the <a href="#">Functionality section</a>.</li> </ol>
	VX-S2 <a href="#">CR-9</a>	<p>For messaging apps, social apps and conversations:</p> <ol style="list-style-type: none"> <li>1. Use the <a href="#">MessagingStyle</a> notifications for conversations.</li> <li>2. Support the <a href="#">direct reply action</a>.</li> <li>3. Support <a href="#">conversation shortcuts</a>, and implement best practices for getting the <a href="#">best direct share ranking</a>.</li> <li>4. Support <a href="#">bubbles</a>.</li> </ol>
UI and Graphics	VX-U1 <a href="#">CR-5</a>	<p>The app supports landscape and portrait orientations and folded and unfolded device states.</p> <p>Orientations and fold states expose essentially the same features and actions and preserve functional parity.</p>
	VX-U2 <a href="#">CR-5</a>	<p>App fills the app window in both orientations and is not letterboxed because of configuration changes, including device folding and unfolding.</p> <p>Minor letterboxing to compensate for small variations in screen geometry is acceptable.</p>
	VX-U3 <a href="#">CR-5</a>	<p>The app correctly handles rapid transitions between display orientations and device folding and unfolding without display rendering problems and without losing state.</p>
Visual quality	VX-V1 <a href="#">CR-all</a>	<p>The app displays graphics, text, images, and other UI elements without noticeable distortion, blurring, or pixelation.</p>

		<ol style="list-style-type: none"> <li>1. The app should use <a href="#">vector drawables</a> where possible.</li> <li>2. The app provides high-quality graphics for all targeted screen sizes and form factors.</li> <li>3. No aliasing at the edges of menus, buttons, and other UI elements is visible.</li> </ol>
	VX-V2 <a href="#">CR-all</a>	The app displays text and text blocks in an acceptable manner for each of the app's supported languages. <ol style="list-style-type: none"> <li>1. Composition is acceptable in all supported form factors.</li> <li>2. No cut-off letters or words are visible.</li> <li>3. No improper word wraps within buttons or icons are visible.</li> <li>4. There is sufficient spacing between text and surrounding elements.</li> </ol>
	VX-V3 <a href="#">CR-all</a>	The app's content, and all web contents referred to by the app, support <a href="#">dark theme</a> .
Accessibility	VX-A1 <a href="#">CR-all</a>	Touch targets should be at least 48dp in size. <a href="#">Learn more</a> .
	VX-A2 <a href="#">CR-all</a>	The app's text and foreground content should maintain a high enough color contrast ratio with its background: <ul style="list-style-type: none"> <li>• 3.0:1 for large text / graphics</li> <li>• 4.5:1 for small text (text smaller than 18pt, or if the text is bold and smaller than 14pt)</li> </ul> <p>Learn more about <a href="#">color and contrast</a>.</p>
	VX-A3 <a href="#">CR-all</a>	<a href="#">Describe each UI element</a> , except for TextView, using contentDescription.

## Functionality

Your app should implement the expected functional behavior.

Area	ID	Tests	Description
Audio	FN-A1	<a href="#">CR-1</a> <a href="#">CR-8</a>	Audio resumes when the app returns to the foreground, or indicates to the user that playback is in a paused state.
	FN-A2	<a href="#">CR-1</a> <a href="#">CR-2</a> <a href="#">CR-8</a>	If audio playback is a core feature, the app should support <a href="#">background playback</a> .
	FN-A3	<a href="#">CR-o</a>	When the user initiates audio playback, the app should do one of the following within one second: <ol style="list-style-type: none"> <li>1. Start playing the audio.</li> <li>2. Provide a visual indicator that the audio data is being prepared.</li> </ol>
	FN-A4	<a href="#">CR-o</a>	The app should request <a href="#">audio focus</a> when audio starts playing and abandon audio focus when playback stops.

Media	FN-A5	<a href="#">CR-o</a>	The app should <a href="#">handle other apps' requests for audio focus</a> . For example, an app might reduce playback volume when another app plays speech.
	FN-M1	<a href="#">CR-o</a> <a href="#">CR-6</a> <a href="#">CR-8</a>	If the app plays audio in the background, it must create a <a href="#">Notification styled with MediaStyle</a> .
	FN-M2	<a href="#">CR-o</a>	If the app plays video, it should support <a href="#">picture-in-picture</a> playback.
Sharing	FN-M3	<a href="#">CR-o</a>	If the app encodes video, it should do so using the HEVC video compression standard.
	FN-S1	<a href="#">CR-o</a>	The app should use the <a href="#">Android Sharesheet</a> when sharing content. It can suggest targets that are unavailable to custom solutions.
Background Service	FN-B1	<a href="#">CR-6</a>	The app avoids running unnecessarily long services in the background. To ensure the smooth running of the user's device, the system applies various <a href="#">restrictions on background services</a> . These are not considered good uses of background services: <ul style="list-style-type: none"> <li>• Maintaining a network connection for notifications</li> <li>• Maintaining a Bluetooth connection</li> <li>• Keeping the GPS powered-on</li> </ul>

Learn how to [choose the right solution for your work](#).

## Performance and stability

Your app should provide the performance, stability, compatibility, and responsiveness expected by users.

Area	ID	Tests	Description
Stability	PS-S1	<a href="#">CR-all</a> <a href="#">SD-1</a>	The app does not <a href="#">crash</a> or <a href="#">block the UI thread</a> causing ANR (Android Not Responding) errors. Utilize <a href="#">Google Play's pre-launch report</a> to identify potential stability issues. After deployment, pay attention to the <a href="#">Android Vitals</a> page in the Google Play developer console.
Performance	PS-P1	<a href="#">CR-all</a> <a href="#">SD-1</a>	<a href="#">The app loads quickly</a> or provides onscreen feedback to the user (a progress indicator or similar cue) if the app takes longer than two seconds to load.
	PS-P2	<a href="#">CR-all</a> <a href="#">SD-1</a>	Apps should render frames every 16ms to achieve 60 frames per second. Developers can use the <a href="#">Profile HWUI rendering</a> option in testing. If there are issues, tools are available to help diagnose <a href="#">slow rendering</a> .
	PS-P3	<a href="#">PM-1</a>	With StrictMode enabled (see <a href="#">StrictMode Testing</a> , below), no red flashes (performance warnings from StrictMode) are visible when testing the app. Any red flashes indicate bad behaviors regarding storage, network access, or memory leaks.
SDK	PS-T1	<a href="#">CR-o</a>	The app runs on the latest public version of the Android platform without crashing or severely impacting core functionality.
	PS-T2	<a href="#">SP-1</a>	The app <a href="#">targets the latest Android SDK</a> needed to align with Google Play requirements by setting the targetSdk value.
	PS-T3	<a href="#">SP-1</a>	The app is built with the latest Android SDK by setting the compileSdk value.

PS- [SP-2](#) [Any Google or third-party SDKs used are up-to-date](#). Any improvements to  
T4 [SP-3](#) these SDKs, such as stability, compatibility, or security, should be available to users in a timely manner.

For Google SDKs, consider using SDKs powered by [Google Play services](#), when available. These SDKs are backward compatible, receive automatic updates, reduce your app package size, and make efficient use of on-device resources.

The developer is accountable for the entire app's codebase, inclusive of any third-party SDKs used.

PS-T5 [SP-3](#) The app does not use [non-SDK interfaces](#).

PS- [SP-2](#) No debug libraries are included in the production app. This can cause  
T6 performance as well as security issues.

Battery PS-B1 [BA-1](#) The app properly supports the power management features that were introduced in Android 6.0 (Doze and App Standby). In the case where core functionality is disrupted by power management, only qualified apps may request an exemption. See [Support for other use cases](#) in Doze and App Standby.

During development, developers can test app standby and doze behavior using [these ADB commands](#).

In terms of battery usage, developers can use the [Android Studio energy profiler](#) or the [Battery Historian](#) tool, combined with planned background work, to diagnose unexpected battery use.

## Privacy & security

Your app should handle user data and personal information safely, with the appropriate level of permission.

In addition to this checklist, applications published on the Google Play Store must also follow the [User Data policies](#) to protect users' privacy.

Area	ID	Tests	Description
Permissions	SC-P1	<a href="#">SC-4</a>	The app requests only the <i>absolute minimum</i> number of permissions that it needs to support its use case at hand. For some permissions such as location, use coarse location in place of fine location if possible.
	SC-P2		The app requests permission to access sensitive data (such as <a href="#">SMS</a> , <a href="#">Call Log</a> , or <a href="#">Location</a> ) or services that cost money (such as Dialer or SMS) only when directly related to the core use cases of the apps. Implications related to these permissions should be prominently disclosed to the user.
<p>Depending on how you are using the permissions, there might be an <a href="#">alternative way</a> to fulfill your app's use case without relying on access to sensitive information. For example, instead of requesting permissions related to a user's contacts, it may be more appropriate to request access by using an <a href="#">implicit intent</a>.</p>			

	SC-P3	<a href="#">CR-o</a>	The app requests runtime permissions in context, when the functionality is requested, rather than upfront during app startup.
	SC-P4	<a href="#">CR-o</a>	The app clearly conveys why certain permissions are needed or follow the recommended flow to <a href="#">explain why it needs a permission</a> .
	SC-P5	<a href="#">CR-o</a>	The app should <a href="#">gracefully degrade</a> when users deny or revoke a permission. The app should not prevent the user from accessing the app altogether.
Data & Files	SC-DF1	<a href="#">SC-1</a>	All sensitive data is <a href="#">stored in the app's internal storage</a> .
	SC-DF2	<a href="#">SC-10</a>	<a href="#">No personal or sensitive user data</a> is logged to the system log or an app-specific log.
	SC-DF3		The app does not use any <a href="#">non-resettable hardware IDs</a> , such as the IMEI, for identification purposes.
Identity	SC-ID1	<a href="#">CR-o</a>	The app provides <a href="#">hints to autofill</a> account credentials and other sensitive information, such as credit card info, physical address, and phone number.
	SC-ID2	<a href="#">CR-o</a>	Integrate <a href="#">One Tap for Android</a> for a seamless sign in experience.
	SC-ID3	<a href="#">CR-o</a>	The app supports <a href="#">biometric authentication</a> to protect financial transactions or sensitive information, such as important user documents.
App Components	SC-AC1	<a href="#">SC-5</a>	The app sets the android:exported attribute explicitly for all <a href="#">activities</a> , <a href="#">services</a> , <a href="#">broadcast receivers</a> , and especially <a href="#">content providers</a> .
			Only application components that <i>share data with other apps</i> , or components that <i>should be invoked by other apps</i> , are <a href="#">exported</a> .
	SC-AC2	<a href="#">CR-o</a> <a href="#">SC-4</a>	All intents and broadcasts follow best practices: <ol style="list-style-type: none"> <li>1. <a href="#">Use explicit intents</a> if the destination application is well defined.</li> <li>2. <a href="#">Use Intents to defer permissions to a different app that already has the permission</a>.</li> <li>3. <a href="#">Share data securely across apps</a>.</li> <li>4. Intents that contain a payload are <a href="#">verified before use</a>.</li> <li>5. If you need to pass an Intent to another app, so that the receiving app can invoke and expect a callback in the calling app, do not include a nested intent in the extras. Use a PendingIntent.</li> <li>6. When setting up your PendingIntents, explicitly set the <a href="#">immutable flag</a>, where applicable.</li> </ol>
	SC-AC3	<a href="#">SC-3</a>	All components that <i>share content between your apps</i> use <a href="#">android:protectionLevel="signature"</a> for <a href="#">custom permissions</a> . This includes <a href="#">activities</a> , <a href="#">services</a> , <a href="#">broadcast receivers</a> , and especially <a href="#">content providers</a> .
			Apps should not rely on accessing a list of installed packages. The access has been restricted beginning in Android 11.
Networking	SC-N1	<a href="#">SC-9</a>	All network traffic is sent over <a href="#">SSL</a> .
	SC-N2	<a href="#">SC-6</a>	The application declares a <a href="#">network security configuration</a> .

	SC-N3	If the application uses Google Play services, the <a href="#">security provider is initialized at application startup</a> .
WebViews	SC-W1 <a href="#">SC-6</a>	Do not use <a href="#">setAllowUniversalAccessFromFileURLs()</a> for accessing local content. Instead, use <a href="#">WebViewAssetLoader</a> .
	SC-W2 <a href="#">SC-7</a>	WebViews <a href="#">should not use addJavaScriptInterface()</a> with untrusted content.
Execution		On Android 6.0 and above, use <a href="#">HTML message channels</a> instead.
	SC-E1	The app does not <a href="#">dynamically load</a> code from outside the app's APK. Developers should use <a href="#">Android App Bundles</a> , which includes <a href="#">Play Feature Delivery</a> and <a href="#">Play Asset Delivery</a> .
Cryptography		As of August 2021, the use of Android App Bundles is mandatory for all new apps in the Google Play Store.
	SC-C1	The app <a href="#">uses strong, platform-provided cryptographic algorithms and a random number generator</a> . Also, the app does not implement custom algorithms.

## Google Play

Be sure that your apps can be published on Google Play.

Area	ID	Tests	Description
Policies	GP-P1	<a href="#">GP-all</a>	The app strictly adheres to the terms of the <a href="#">Google Play Developer Content Policy</a> and does not offer inappropriate content, does not use the intellectual property or brand of others, and so on.
	GP-P2	<a href="#">GP-1</a>	The app maturity level is set appropriately, based on the <a href="#">Content Rating Guidelines</a> .
App Details Page	GP-D1	<a href="#">GP-1</a> <a href="#">GP-2</a>	The app's feature graphic follows the guidelines outlined in this <a href="#">support article</a> . Make sure that: <ul style="list-style-type: none"> <li>1. The app listing includes a high-quality feature graphic.</li> <li>2. The feature graphic does not contain device images, screenshots, or small text that will be illegible when scaled down and displayed on the smallest screen size that your app is targeting.</li> <li>3. The feature graphic does not resemble an advertisement.</li> </ul>
	GP-D2	<a href="#">GP-1</a>	The app's screenshots and videos do not show or reference non-Android devices.
	GP-D3	<a href="#">GP-1</a>	The app's screenshots or videos do not represent the content and experience of your app in a misleading way.
	GP-X1	<a href="#">GP-1</a>	Common user-reported bugs in the Reviews tab of the Google Play page are addressed if they are reproducible and occur on many different devices. If a bug occurs on only a few devices, you should still address it if those devices are particularly popular or new.

# Accessibility

## Design for vision

Ensure your app's content is as legible as possible by checking color contrast and text sizing, and that components are visually comprehensible and easy to discern from each other.

Follow these guidelines to design for vision accessibility.

- To allow users to adjust the font size, specify font size in [scalable pixels \(sp\)](#)
- Don't make the body size any smaller than 12 sp. This guideline aligns with the Material typescale as a default.
- Ensure the contrast between the background and text is at least 4.5:1. [Learn how to check color contrast.](#)
- Use a 3:1 ratio between surfaces and non-text elements. For example, the ratio of a background to an icon would be 3:1.
- Use more than one visual affordance for actions like links.

Use Material's [Accessible color system](#). This color system is based on tonal palettes, and is central to making color schemes accessible by default.

## Design for sound

[TalkBack](#) is a Google screen reader included on Android devices that gives users eyes-free control. You can manually test this by [exploring your app with TalkBack](#) or with the [A11y scanner](#).

Follow these guidelines to ensure your app is prepared for screen readers:

- [Describe UI elements](#) in your code. Compose uses [Semantics properties](#) to inform accessibility services about the information shown in UI elements.
- To satisfy Android framework requirements, provide additional textual description of icons and images.
- Set decorative item descriptions to null.
- To allow skipping between blocks of actions and content, consider UI granularity and group UI elements..

Check out Material's [Design to Implementation Walk](#), which walks you through accessibility considerations and notation using Web Content Accessibility Guidelines (WCAG).

## Design for audio

Android provides features to enable users to interact with their devices through a variety of voice commands and queries.

The [Voice Access](#) app for Android lets you control your device with spoken commands. Use your voice to open apps, navigate, and edit text hands-free.

## Design for motor skill

[Switch Access](#) lets users interact with your Android device using one or more devices, which can be helpful for users with limited dexterity who have trouble interacting directly with a touch screen.

Manually test by [exploring switch access](#).



- Don't rely on gestures to complete all actions; [create accessibility actions](#) to support all user flows in your app.
- Ensure all touch targets are at least 48 dp, even if this extends past the UI element visual.
- Consider [haptic feedback](#) to help inform the user with additional, real-time sensory input.